NERRS Science Collaborative Progress Report for the Period 3/1/13 through 8/30/13
Project Title: Integrating Socio-Ecological Research and Collaborative Learning to Promote Marsh and Community Resilience
Principal Investigators: Brian Needelman, Michael Paolisso, Patricia Delgado, Lisa Wainger, Paul Leisnham, Andrew Baldwin, Robert Tjaden
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Report compiled by: Brian Needelman
Contributing team members and their role in the project:
Project coordinator: Brian Needelman
Collaboration lead: Michael Paolisso
Fiscal agent: Robert Tjaden
Applied science investigators: Patricia Delgado, Chris Snow, Lindsay Carroll, Sasha Land, Coreen Weilminster, Lisa Wainger, Paul Leisnham, Andrew Baldwin, Donald Webster, Erin McLaughlin, Kevin Smith, Patrick Megonigal, Christine Conn, Sean McGuire, Roman Jesien, Natasha Leuchanka
Intended user representatives: Captain Stoney Whitelock, Roy Ford, Michael Cantwell, Steve Strano, Susan Adamowicz

A. Progress overview

The goals of this project are to: 1) Establish a continuing collaboration among local community, state and federal agency, academic, and non-governmental organization stakeholders working towards the resilience of the marshes and local communities of the Deal Island peninsula; 2) Develop and test a broadly transferable process of engaging stakeholders to optimize and implement strategies that restore and conserve marshes and local communities; and 3) Better understand the provision of socio-ecological services by marsh systems and decision-making processes within the stakeholder community using integrated anthropological, economic, and ecological applied science.

We are using collaborative learning as our key methodology for stakeholder engagement. During the second project period, we held our first stakeholder workshop, developed three Collaborative Research Projects (CRP) on the subjects of Heritage, Flooding, and Marsh Restoration, and held our CRP Kickoff Meeting. Our applied science research includes ecological, economic, and anthropological components. During this project period we continued extensive ecological data collection at seven field sites, initiated economic data collection using a Q-sort methodology at the CRP Kickoff Meeting, and continued to develop economic and anthropological methods for integration into the CRP process.

B. Working with Intended Users

In this section of the report, we describe the collaborative learning element of our project, which is our key method for working with our stakeholders. We also discuss our outreach and education efforts.

- **Describe the progress on tasks related to the integration of intended users into the project for this reporting period.**

Since March, project collaboration has achieved a number of milestones. We have identified our collaborative learning process stakeholders, held our 1st workshop with these stakeholders to develop and refine our objectives, developed smaller working teams (Collaborative Research Projects: CRPs), held a CRP kick-off meeting, and now the CRPs are working to implement their shared goals and objectives.

Governance:

The collaborative learning process is being conducted using a variety of means and mechanisms. Michael Paolisso, the Collaborative Lead, is our primary contact with local community stakeholders. He has worked closely with project director Brian Needelman and Katherine Johnson in developing protocols and materials to be discussed with the project's Collaborative Science Team (CST). The CST is comprised of representatives of the project's research disciplines: Paolisso (anthropologist), Needelman (ecologist), Johnson (anthropologist), Bob Tjaden (economist), Lisa Wainger (economist), Diane Leason (ecologist), and Sasha Land (training and outreach). The CST holds weekly teleconferences to discuss project collaboration activities. All have been involved in identifying, initiating, and maintaining stakeholder contacts.

With this next phase of the project, and the introduction of the CRPs, the Collaborative Science Team has changed slightly and will serve a dual purpose to be a site for communication regarding the CRPs. Each CRP has stakeholder leadership representing the local communities and other organizations. Together, the Collaborative Science Team and CRP leaders will help to provide the organizational support for the three CRP teams.

Stakeholders:

We currently have just under 50 collaborative learning project stakeholders. They represent the grant, the local community, and officials and managers from local and regional organizations. We anticipate that this group will participate through the remainder of our collaborative learning activities, but there could be a few additions as key people are targeted and brought in for various reasons. While not all of the stakeholders are ever able to make it to our large events (1st workshop, CRP kick-off meeting) we maintain contact with those absent and send summaries or reports to keep them up to date.

1st Workshop:

The first workshop was held to 1) engage stakeholders in our initial public collaborative learning process, 2) give further explanation to project stakeholders, 3) capture information from stakeholders about the importance of the marsh and community, concerns, vulnerabilities, and actions to protect community and marsh. The workshop was held on April 6, 2013 and had 28 attendees. Chris Feurt facilitated the

workshop. Kalle Matso was present as an observer and he also provided feedback after the workshop.

A condensed list of important discussion points of concern and vulnerability were:

- Historic use and management of the marshes
- Shoreline erosion, berms, subsidence, sea level rise, storm surge, salinity intrusion, mosquitos
- Loss of economic diversity, threat of prohibitively expensive flood insurance
- Poor management and development decisions at all levels
- Collapse of community, loss of heritage, continued resilience of the population
- Interconnectedness of the community and the environment
- Constraint through regulation
- Lack of communication and knowledge sharing among environmental managers and community

Based on evaluation of the workshop we are pleased to report that:

- All agreed the workshop was a good start to the effort and use of their time
- Nearly everyone felt they had an opportunity to share their knowledge
- Most reported they now know about another point of view to learn more about
- A majority were hopeful this collaboration will be able to address the issues at hand
- 14 of 28 participants said they had been doing their work for over 20 years

Ideas for actions to protect marsh and community are not reported here because they are preliminary. The primary purpose of the workshop was to gain a key understanding of the community's thoughts and concerns regarding resilience of marsh and community. The work of establishing goals and action items will occur within the CRPs.

<u>Collaborative Research Project (CRP) Teams:</u>

The purpose of the collaborative research projects are to:

- To collect information on heritage, flooding and marsh restoration for the Deal Island Peninsula
- Bring together project stakeholders' knowledge and expertise;
- Identify cultural, social, economic, and ecological information relevant to community and marsh adaptation to climate-related change;
- Identify individuals, institutions and decision-makers who can use information collected by CRPs in ways that increase community and marsh resilience;
- Provide a mechanism to inform and engage a wider range of interested individuals in the project; and
- Achieve some group-based decisions on future actions to improve community and marsh resilience to sea level rise and flooding.

We formed three CRP Teams:

Heritage: Heritage is an important topic to the Deal Island Peninsula communities. A number of our stakeholders represent organizations that are working to promote heritage research and conservation. Heritage is a concept that can mean both public and private heritage. The latter is defined as "what a community wants to pass on to the next generation." (Note: private and public heritage do overlap.) The project can complement existing heritage work in the communities, which focuses on public heritage (e.g., material culture for display), by collecting additional information on private heritage through interviews. Improved shared understanding of private and public heritage can be a cultural asset that helps promote community identity and a sense of belonging. Such cultural beliefs and values can help make a community more resilient in the face of future ecological and socio-economic challenges, including climate change. The marshes are a major site of heritage construction. They provide a service in helping to sustain community heritage, along with fisheries and other local social processes.

Flooding: A major concern for the Deal Island Peninsula and its communities is flooding, including the possibility on increased flooding due to climate change and sea level rise. The topic of flooding surfaced many times during our discussions with project stakeholders and at the first workshop. A project focused on flooding could include a wide range of topics, such as historical to current patterns of flooding, economic costs of flooding, marshes to mitigate storm surges, shoreline protection, sea level rise impacts, flood insurance, adaptation options and policies at county, state and federal levels, etc. Research on these processes and impacts is a service that will provide knowledge and help build social relations between project stakeholders and others that could help improve marsh and community socio-ecological resilience. In particular, learning about how the marshes respond to flooding and/or function to regulate flooding and or can be protective against flooding would be very useful to community stakeholders, including how changes in marshes will affect future flooding on non-marsh lands where they reside and areas of potential non-marsh to marsh transition.

Marsh Restoration: The local marshes provide many cultural, economic and ecological services. The marshes are vulnerable to sea level rise and flooding, which are projected to increase with climate change. We are exploring options for ditch-drained marsh restoration within our project; this collaborative research project will include this work as well as other marsh restoration and management options in the peninsula. Project stakeholders are very interested in the drivers of ecological change in the marshes and cultural and economic benefits that are at risk due to changing climatic conditions. Possible topics of relevance to marsh socio-ecological services include GIS mapping of past and present uses of the marshes; identification of locations in the marshes at risk of SLR impacts or not; cultural and economic benefits and services of the marshes; identification of marsh areas that are most suitable for restoration and would provide the greatest benefits; and the general potential and limitations of restoration.

Participation in these three CRP teams is voluntary and based on a stakeholder's interests. Each team has about 14 members. Leadership from among the stakeholders

within each CRP combined with support from the Collaborative Science Team serves as the organizing body for each team. There are some stakeholders for whom participation in the CRPs is not feasible, these people will be kept informed of what is happening in the CRPs and invited to our second all-stakeholder workshop in October 2013. The primary organizing event for the CRPs was the CRP Kick off meeting.

CRP Kick-Off Meeting and Ongoing Work:
The CRP kick-off meeting was held July 24, 2013. We had 26 attendees. In addition to organizing the CRPs, a Q sort activity was conducted as part of the project's economic research focus (see economics section under part B).

At the CRP meeting we gave attendees a reminder of the overall project goals and ongoing activities. We then went over the purpose of the CRPs and gave everyone an idea of what they should expect their working relationship within their CRPs to look like.

This is what we asked each CRP to do:

- Keep track of group membership and participation
- Take notes of meetings/activities and action plans
- Make sure your group work (heritage, flooding, or marsh restoration) is tied back to our overall goal: to build marsh and community resilience in the face of future climate change.
- Let us know what we can do to assist your group in its proposed and ongoing activities.
- Create an action plan (5-10 goals) that your group would like to accomplish. These can include: research, data collection, report writing, interviews, etc. – pretty much anything!
- Present on your progress toward these goals at our October workshop, but there will be time to keep working toward these goals through next Spring.

Stakeholders broke into their CRP groups and began a structured activity to help define their main concerns and potential action items. First, concerns were identified. Those that were related to climate and environmental change impacts, as well as sustainability of marshes and communities, were highlighted. Then, action items related to these concerns were developed and the groups worked together to prioritize several action items. Finally, each group presented to the whole their work, concerns, and potential action items.

Currently, CRP groups are working to finalize their action items with CRP team members who were not able to be present at the CRP meetings. CRP teams will work together over the next three months to complete some of their action items in anticipation of reporting out to the larger group at our second all-stakeholder workshop in October 2013.

- **What did you learn? Have there been any unanticipated challenges or opportunities?**

We have learned that project stakeholders are enthusiastic about the collaboration with each other within and across the CRPs. A challenge that has emerged is how to assist stakeholders in expressing their own knowledge and values, and worry less about whether their ideas are good enough or the right ideas. We are constantly reinforcing the important goal that we desire the integration of all ideas in our CRP discussions and actions. We anticipate that throughout the project we will need to continue to reinforce the ideal, particularly for community stakeholders, that all knowledge and values can be discussed through the collaborative science process.

Our team has also learned that communication with various stakeholders (including the project team) has been quite time intensive and requires multiple strategies. Meetings, email, phone calls, or face-to-face conversations have been key depending on the group/individual. Managing this has been challenging, and has required more time to organize people for workshops and activities than was expected.

- **Has interaction with intended users brought about any changes to your methods for integration of intended users, the intended users involved, or your project objectives?**

Yes, we have made two significant adjustments to our methods as a result of interactions with our stakeholders. Our initial plan was to select three focus socio-ecological services for Collaborative Research Projects (CRPs). However, after the first workshop and through other interactions we found that individual services were too specific, our stakeholders were thinking and conceptualizing the socio-ecological system at a broader scale. For this reason, we chose higher-level focus areas for the CRPs: heritage, flooding, and marsh restoration.

Also, we found that we didn't have the appropriate structure in our project organization for outreach and education; we therefore have formed an Outreach and Education Team consisting of Brian Needelman, Sasha Land, Michael Paolisso, Coreen Weilminster, Natasha Leuchanka, and two community members: Nancy Goldstein and Eileen Cross. This group will be responsible for project-wide messaging and communication, coordination of outreach and education activities, and will take the lead on outreach activities such as our display at the Skipjack Heritage Festival, our newsletter, and our website. The annual Skipjack Festival is a family-friendly event which occurs over Labor Day weekend at Deal Island. The event will serve as an opportunity to reach out to community members and visitors not directly involved in the project. It also became a helpful deadline for the Education and Outreach Team to develop initial outreach and education materials, such as brochures, informational displays, and a project website.

- **How do you anticipate working with intended users in the next six months?**

The CRP groups will be highly active during this project period and will be the focus of our work with stakeholders. The CRPs have not finalized their specific tasks at this time, but preliminary plans include activities such as site tours, interviews, data compilation, and literature reviews. We will communicate with the CRP members through the CRP co-leads, as described above. The major stakeholder event during this project period will be the workshop scheduled for October 19th. Our Outreach and Education Team will oversee our display at the Skipjack Heritage Festival; the writing and distribution of our newsletter; and the writing, publication, and advertising of our website.

C. Progress on project objectives for this reporting period:

In this section, we discuss our progress related to the applied science-related objectives of the project, including ecological, economic, and anthropological research. This work is integrated into the collaborative learning process and stakeholder integration as described under Section B.

- **Describe progress on tasks related to project objectives for this reporting period.**

Ecological applied science

We have continued to make progress on the ecology research. To date, we have collected data, performed laboratory analyses, and begun the analysis of data on hydrology, vegetation, mosquitoes, soils, elevation, nekton, sedimentation and water quality (see detailed list below). We have also completed the installation of the following field equipment at our field sites: wells and water-level loggers, salinity loggers, piezometers, vegetation/mosquitoes/soils plot markers, surface elevation tables, and weather stations.

<u>Methodological summary</u>

Sites
We have seven field sites in this study: five on Deal Island and two at the EA Vaughan Wildlife Management area, a coastal bay site on the eastern shore of Maryland. The EA Vaughan site is outside of the Deal Island Peninsula but is included because it has been established as a restoration study site since 2007 and its inclusion will facilitate the future transfer of our research results to coastal bay communities. The study sites include three pairs of ditched and unditched marshes (two pairs on Deal Island and one at EA Vaughan) and a reference unditched site at the Monie Bay CBNERR-MD site on Deal Island, where data collection will build upon ongoing monitoring efforts.

Data collection methods summary

- Water level and salinity (continuously logged in wells)

- Water pressure (collected during mosquito sampling events at 3 nested piezometers located at 20 plots per site)
- Vegetative species composition and cover (20 plots per site annually)
- Aboveground biomass (20 plots per site annually)
- Belowground productivity (using root in-growth cores) (20 plots per site annually)
- Mosquito larval density and species (40 plots per site 2-3 days following spring tides and following selected storm events)
- Soil horizonation (to one meter) (20 plots per site annually)
- Soil water content and bulk density (20 plots per site annually by soil horizon)
- Soil carbon and nitrogen content (20 plots per site annually by soil horizon)
- Soil rubbed fiber content (20 plots per site annually by soil horizon)
- Elevation (collected using laser leveling at all plots, well locations, and along drainage ditches and creeks; connected to GPS long-term occupations at local benchmarks)
- Surface accretion (using feldspar marker horizons measured twice a year)
- Elevation dynamics (using three Surface Elevation Tables per site; shallow SETs measured four times a year and deep SETs twice a year during the growing and non-growing seasons)
- Nekton (measured twice a year during the summer)
- Water quality (measured twice a year during the summer)
- Sedimentation (using sedimentation tiles)

Preliminary mosquito results

In 2012, all collected mosquitoes were only one species: *Anopheles bradleyi*. At two of the three paired locations, unditched sites had 2-3 times the proportion of sample plots on the marsh surface infested by mosquitoes compared to the ditched sites. The third paired location (DEA1-2) had very little infestation. consistent with past studies, mosquitoes varied considerably in space and time. In the first half of the 2013 summer mosquito season, we are finding a greater number of mosquito species. We have expanded sampling to include ditches, and permanent ponds and creeks, which were mapped in 2012. It is too early to discern if trends between ditched and unditched sites in 2013 are consistent with 2012 results.

Economics applied science

Progress overview

We are exploring how ecosystem service language and metrics can be better matched to user values with the short term goal of integrating a full range of stakeholders in management of the Deal Island Peninsula socio-ecological system and the long-term goal of improving valuation techniques and communication between scientists, managers, and the public.

Approach

The economics component of the project is tightly integrated with the social science research as we jointly seek to gain a fuller understanding of how people benefit from marsh ecosystems and the socio-ecological services they provide. In addition, the

economics team is testing several hypotheses regarding how people form values for ecosystem services and what language works to best communicate those values. To inform this research, we are eliciting values at multiple points in the process using Q-sorts of the stakeholder group.

A Q-sort is a common social science research tool used to assess diverse viewpoints on a topic. The Q-sort is conducted by having participants sort statements about a topic within a distribution from more to less important. The technique is similar to pile-sorting techniques that are also in widespread use, but it requires the respondents to set priorities as to the most and least important issues related to a topic.

The socio-economic applied research team conducted a Q-sort at the beginning of the Collaborative Research Projects (CRP) community workshop on July 24, 2013. A total of 26 people, including the research team, attended the workshop and participated in the sorting exercise. Stakeholders at the CRP workshop were asked to distribute 19 cards, each containing a socio-ecological service, along a pre-determined distribution from most and least important to sustain (Figure 1). The statements on the cards represented socio-ecological services, which were derived from stakeholder input during the first stakeholder workshop held in April 2013 (Table 1).

Data are being analyzed using factor analysis to test for several effects including similarities across stakeholder groups and patterns across and among different types of services. With the results of the Q-sort activity, we hope to find out what ecosystem services are of greatest value to project stakeholders and what trade-offs of services exist among stakeholders.

Table 1. Socio-ecological services used in Q-sort

Socio-Ecological Services
Marshes reducing storm and erosion impacts
Natural mosquito control (from marsh ecosystem)
Marsh system vitality over the long-term
Teaching children about nature and stewardship
Beautiful place to live
Global climate regulation (from carbon sequestration)
Marsh study to promote scientific knowledge
Livelihood for watermen
Active commercial areas (restaurants, stores, etc.)
Locally caught seafood for sale
Local heritage tourism
Habitat for juvenile fish, crabs and oysters
Safe water for swimming and boating
Understanding of heritage and culture of area
Attractive natural setting
Successful fishing and hunting
Wildlife habitat for enjoyment or use by future generations
Property value protection (home price appreciation)
Seeing nature and wildlife

Figure 1. Q-sort template used to prioritize statements in Table 1.

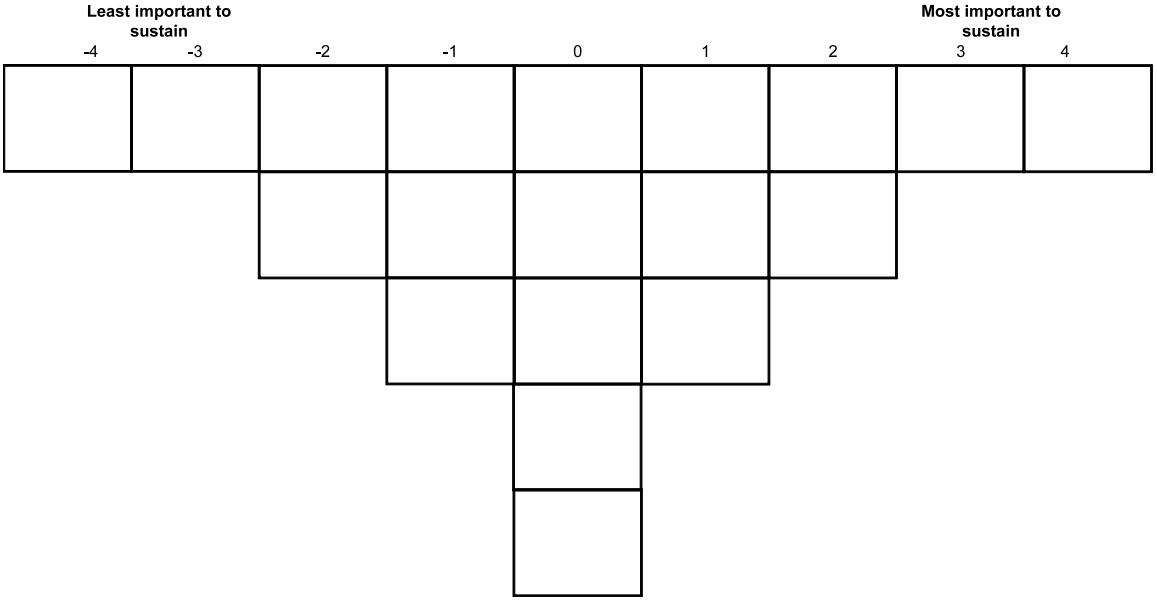

Figure 2. Layout of Q-sort activity.

Anthropological applied science

The anthropological applied science work completed so far has emphasized the holistic integration of various stakeholder knowledge, expertise, and values.

Geospatial analyses

During this project period, we have focused our geospatial analysis work of the Deal Island Peninsula on the acquisition and processing of historical aerial photos. We have acquired a set of photos from 1938 and 1958, which we are georeferencing and merging to generate digital maps for the entire peninsula. These maps will be used throughout the project including all three of the Collaborative Learning Projects described above.

- **What are your plans for meeting project objectives for the next six months?**

We will continue to collect ecological field data, conduct laboratory analyses, and analyze data. We are planning an ecological team meeting for January 2014 to share our analyzed data sets from 2013. The marsh restoration is scheduled to occur in the winter of 2014.

For the applied anthropological science, we will be implementing semi-structured interviews with project stakeholders to further elicit core cultural and social information that influences collaboration and also contribute to marsh and community resilience. We will also include in these semi-structured interviews questions that help us further define and understand the concept of resilience, and the structure and process of the emerging socio-ecological system within which practices of resilience are framed. We will also develop a survey to collect quantitative information that should help us measure the degree of sharing among project stakeholders, and the communities they represent, in their understanding and practice of marsh and community resilience in the face of climate change impacts.

Overall, we will continue our efforts to investigate and analyze the socio-ecological system through interviewing and other data collection. Research in the CRP areas of flooding, marsh restoration, and heritage (as outlined above) will be ongoing, requiring collaboration between project team members and the community via collaborative learning activities. Our focus will be on integrating the anthropological, economic, and ecological research within the collaborative learning process to build resilience for the Deal Island Peninsula.

D. Benefit to NERRS and NOAA

The process by which the project is using to engage stakeholders through the community workshops and Community Research Projects is one that can be replicated by the NERRS for a variety of projects. Though this is still in the beginning stages there is a high level of involvement from many different sectors. An Outreach and Education Team for the project has been formed to help communicate about the different aspects of this project. Moving forward the products and outcomes from this group could serve as examples on how to engage different audiences about the work of Science Collaborative Projects.

The protocols utilized and the monitoring infrastructure that has been put in place through this project have the potential for this study area to become a climate change sentinel site in the future. This is highly valuable in establishing another location in a vulnerable coastal area to understand more locally the impacts of a changing climate. Through the networks that the project is establishing/identifying, the information generated has the potential of being utilized in management and restoration decisions.

Our outreach and education materials are not scheduled to be produced until later in the project timeline. Some preliminary outreach and education materials have been produced in preparation for the annual Skipjack Festival at Deal Island on Labor Day weekend including informational brochures and display boards that describe the project, why it is happening, its components, partners involved, how those interested can get involved, and who to contact for more information.

E. Describe any activities, products, accomplishments, or obstacles not addressed in other sections of this report that you feel are important for the Science Collaborative to know.

None.